



Revisions to Original Claims

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1. A comprehensive [NG] gas processor for removing the moisture and recovering the higher hydrocarbons (i.e., C_2^+) therein either on-situ in a gas field or in a plant comprising:

- (a) an integrated [NG] gas processor adopting comprising two sections working on a hybrid process, i.e., an integration of two different processes within a single casing:
- i) a refrigeration-dehydration section working on refrigeration process wherein the inlet gas contacts with a counter-flowing stream of dispersed cold heat-transport medium containing a non- or low-volatile hydrate inhibitor with boiling point higher than 180°C and the moisture of said gas is condensed and removed with the cold heat-transport medium; and
- ii) an absorption section working on low-temperature absorption process wherein the dehydrated gas contacts with a counter-flowing stream of dispersed liquid absorbent with a hydrocarbon gas solubility higher than 20 scf/gal wherein the higher hydrocarbons (i.e., C_2^+) are absorbed.

[and connected to the raw NG inlet pipeline and the lean NG outlet pipeline;]

- (b) a heat-transport medium cooler [connected to the medium inlet and transfer pipelines;] comprising a pre-cooling stage and a deep-cooling stage wherein in said pre-cooling stage said heat-transport medium is pre-cooled with the cold outlet gas left said integrated gas processor and in said deep-cooling stage the medium is deep-cooled with the refrigerant provided with a refrigerator;
- (c) an absorbent cooler [connected to the absorbent inlet and recycle pipelines;] comprising a pre-cooling stage and a deep-cooling stage wherein in said pre-cooling stage said recycling absorbent is pre-cooled with the cold outlet absorbent left said integrated gas processor and in said deep-cooling stage the absorbent is deep-cooled with the refrigerant provided with a refrigerator;
- (d) a fractional distiller [connected to the rich oil transfer and outlet pipelines, the absorbent outlet pipeline, and the product outlet pipeline.] for separating the absorbed higher hydrocarbons as a product from the outlet absorbent left said integrated gas processor

and then the [latter] separated absorbent is recycled back to said integrated gas processor;

- (e) an inhibitor regenerator [connected to the effluent transfer pipeline, the inhibitor recycle pipeline and the wastewater discharge pipeline;] for concentrating the low-volatile hydrate inhibitor to be recycled and discharging the wastewater;
 - (f) a [refrigeration unit connected to the refrigerant inlet and outlet pipelines] refrigerator for providing the refrigerant to said deep-cooling stages of said heat-transport medium cooler and said absorbent cooler;
 - (g) a pipeline for delivering the recovered higher hydrocarbons; and
 - (h) a gas inlet pipeline and a pipeline for delivering the [lean NG] processed gas.
2. A comprehensive [NG] gas processor of claim 1 wherein the dehydration section of said integrated processor and its accessories (comprising said heat-transport medium cooler, said inhibitor regenerator, said refrigerator, and said gas inlet pipeline and a pipeline for delivering the processed gas) are operated independently as a [pure NG] gas dehydrator without incorporating the absorption section.
3. A comprehensive [NG] gas processor of claim 1 wherein [a] said heat-transport medium is [in directly contact with the counter-flowing NG in the dehydration section] an aqueous solution of calcium chloride or other ionizing salts and the regeneration rate of said solution is less than 5 liter per kg of wastewater to be discharged.
4. A comprehensive gas processor of claim 1 wherein said heat-transport medium is an aqueous solution of ethylene glycol or other organic compounds with boiling points higher than 180°C and the regeneration rate of said solution is less than 5 liter per kg of wastewater to be discharged.
5. A comprehensive [NG] gas processor of claim 1 wherein [an] said absorbent is [in directly contact with the counter-flowing NG in the absorption section] heavy oil (i.e., hydrocarbon mixture with molecular weight higher than 100) or other organic compounds with hydrocarbon gas solubility higher than 10 scf/gal liquid.
- [5. A comprehensive NG processor of claim 1 wherein the heat-transport medium contains a

gas-hydrate inhibitor.]

[6.A comprehensive NG processor of claim 1 wherein the refrigeration unit is an industrial refrigerator.]

[7]

6. A comprehensive [NG] gas processor of claim 1 when working on inlet gas pressure greater than 5.0 MPa wherein [the refrigeration unit] said refrigerant to said deep-cooling stages of said heat-transport medium cooler and said absorbent cooler is provided with a [NG] gas expansion device.

[8. A comprehensive NG processor of claim 7 wherein a gas-hydrate inhibitor is injected into the NG before entering the NG expansion device.]

[9.A comprehensive NG processor of claim 7 wherein the NG expansion device is a gas expansion valve.]

[10.A comprehensive NG processor of claim 7 wherein the NG expansion device is a turbo expander-compressor.]

[11.]

11 Z A [comprehensive NG processor] gas expansion device of claim [7] 6 wherein [the NG] said expansion [equipment] device is a triple-sectional free-piston [NG] gas expander-compressor-
1.126 booster comprising:

(a) [A] a gas expansion cylinder and a gas compression cylinder;

(b) [A] a co-shaft gas expansion piston and gas compression piston; and

(c) a co-shaft gas-fueled booster piston engine providing supplemental power for compressing said expanded gas to the required delivery pipeline pressure.

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